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AUTHOR Wile, Marcia Z.
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ABSTRACT

The appropriateness of the National Board of Medical Examiners Part I examination was determined as an internal evaluation of second year students at a midwestern medical school. Review of the June 1974 examination by 37 faculty revealed that 85 percent of the items reflected the content of the second year curriculum with information necessary to answer 60 percent provided in the second year teaching. Two-thirds of the items were first year content-related and 50 percent could be answered on the basis of first year material. The school's faculty used the study data in making policy-changing decisions. (Author/RC)

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External Examinations for Internal Evaluation: The National Board Part I Examination as a Case

Marcia Z. Wile, Ph.D.

Division of Research in Medical Education
School of Medicine
Case Western Reserve University
Cleveland, Ohio 44106

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ABSTRACT

External Examinations for Internal Evaluation:
The National Board Part I Examination as a Case

Marcia Z. Wile, Ph.D.
Case Western Reserve University

This study examined the appropriateness of the National Board of Medical Examiners Part I examination as an internal evaluation of second year students at a midwestern medical school. Review of the June 1974 examination by 37 faculty revealed that 85 percent of the items reflected the content of the second year curriculum with information necessary to answer 60 percent provided in the second year teaching. Two-thirds of the items were first year content-related and 50 percent could be answered on the basis of first year material. The school's faculty used the study data in making policy-changing decisions.

The original purpose of the National Board of Medical Examiners (NBME) was to develop certification examinations for the practice of medicine which would be accepted by state licensing boards.[1] Three required examinations for certification were subsequently created, and all states except Arkansas and Louisiana award licenses to diplomates of the NBME.[2] Two of the NBME examinations (Part I and Part II) can be administered to undergraduate medical students. A majority of American medical schools requires its students to take these examinations and uses the results for promotion and/or graduation. In the 1975-1976 academic year, 90 of 119 medical schools in the United States and 1 of 16 medical schools in Canada were reported to require either or both Part I and Part II.[3] This requirement has expanded the role of the NBME to include the evaluation of undergraduate medical education programs.[4]

Although the NBME examinations have been used to measure the effectiveness of medical school curricula, few studies have been reported regarding the congruence of these examinations with an individual school's curriculum. The NBME conducted a study in 1968 to determine the relevance of the Part I examination to current curricula of United States and Canadian medical schools in order to improve future tests.[5] Basic science and clinical science faculty from 103 medical schools reviewed approximately 1800 items from six basic science subtests of recent Part I examinations. A yes-no response was requested as to each item's appropriateness for evaluating student information in the basic science courses of the reviewer's school, and its reflecting essential knowledge which should require a minimum pass level. Ninety percent of the items were considered to represent knowledge appropriate for the basic sciences, and 65 percent of the items were determined to contain essential content.

Medical school faculty at the University of Minnesota participated in

an investigation to assess the relationship between a NBME Part I examination and the school's basic science curriculum.[6] Each coordinator in six basic science departments and selected faculty colleagues reviewed the content area subtest of his discipline of the June 1971 examination. The extent of current curricular emphasis was judged for each item, and recommendations for future teaching emphasis were offered. The results indicated a consistency of most of the items from this one examination with the curricular content. The reviewers accepted the content of the NBME examination as a standard by which to evaluate their curriculum. They also identified areas for additional teaching activity.

This paper describes a study in which the Part I examination was reviewed in terms of its relationship to the curriculum of a particular medical school and the performance of first and second year medical students. Case Western Reserve University (CWRU) School of Medicine has required its students to take Part I and Part II of the NBME examinations since the introduction of the interdepartmental system of teaching in 1952.[7] In this curriculum faculty from several disciplines taught content related to a specific organ system through the organizational unit of the subject committee. The curriculum was divided into three phases: Phases 1 and 2, comprising two and one-half years of pre-clinical curriculum; and Phase 3, encompassing one and one-half years of clinical activities. Initially, students took Part I at the completion of their basic science activities in the third year, and Part II at the end of the fourth year. Both examinations were considered to be external assessments with scores recorded but not used for promotion purposes. The faculty recognized that the integrated subject committee teaching differed markedly from traditional medical school curricula, and did want to determine if the students could qualify on a national certification examination. With the curricular revision of 1968 came a change in the use of the Part I examination. The basic science curriculum was shortened to

two years and the students were required to take Part I at the end of the second year (Phase 2) as the second year comprehensive. Thus, this examination became an internal as well as an external evaluation tool.

In 1970 the NBME changed its policy to permit students to take Part I at the end of the first year.[8] Four first year CWRU students took Part I in 1971, while 40 percent of the first year students took this examination in 1974. During this period approximately 56 percent passed. These students entered the second year of medical school having passed the comprehensive examination without having experienced the Phase 2 curriculum. Since a considerable proportion of the students could pass the Part I examination, the appropriateness of this examination as an internal assessment for the second year was questioned.

This concern about the NBME Part I as an evaluative instrument resulted in a pilot study conducted by the author in 1974. Eighteen faculty members from 12 of the 13 second year subject committees examined the June 1973 NBME Part I examination in relation to the content and teaching activities in Phase 2. These reviewers considered approximately 75 percent of the items to be relevant to the Phase 2 curriculum and information sufficient to answer 53 percent of the items was included in the second year teaching.

The Subcommittee on Intellectual Environment and Evaluation of the School's Committee on Medical Education endorsed an expanded study, conducted in May 1975, which was designed to answer the following questions:

1. To what extent does the NBME Part I examination correspond to the content of the first year (Phase 1) and the second year (Phase 2) curriculum of the CWRU School of Medicine?

2. To what extent does the teaching in the Phase 1 and Phase 2 subject committees emphasize information necessary to answer the items in the NBME Part I examination?

3. What is the level of performance of Phase 1 and Phase 2 CWRU medical students on all items reviewed?

Method

The seven subtests (anatomy, behavioral sciences, biochemistry, microbiology, pathology, pharmacology, and physiology) of the NBME Part I examination administered in June 1974, were reviewed by 37 subject committee chairmen and teaching faculty representing the 7 Phase 1 and 13 Phase 2 subject committees. Each person judged every item as relevant or not relevant to the content of his particular subject committee. If the item were content-related the reviewer was asked to indicate one of the following:

1. If information necessary to answer the item was taught in the subject committee which he represented.

2. If information necessary to answer the item was not taught in his subject committee.

3. If the reviewer did not know if information necessary to answer the item was taught in his subject committee.

Additionally, the reviewers were encouraged to identify those items which were ambiguous, trivial, or had an incorrect answer indicated. They were also requested to specify the areas taught in their subject committee teaching which were not tested by this particular NBME examination.

This examination was taken by 121 second year students (class of 1976) and 16 first year students (class of 1977). An item analysis of the performance of both the second year and first year CWRU students which reported the percentage of correct answers for the local group and the national reference group was obtained from the NBME.

There was a total of 1029 items in the total test, but 41 were deleted by the NBME because of the items' poor performance. The individual faculty reviews were summarized to generate a final judgment for each of the 988 items. If at least one faculty member considered the item to be relevant, it was categorized as relevant. If at least one reviewer indicated the relevant subject was taught, the item was classified as being taught.

In all cases the intent was to include items as related to the CWRU curriculum, not to exclude them. Each item was assigned to one of four categories: not relevant, relevant and taught, relevant and not taught, and relevant and don't know if taught. An analysis was completed for Phase 1 items, Phase 2 items, and combined Phase 1 and Phase 2 items. This was done for the total test and each of the seven subtests. Total test and subtest mean scores obtained by first year and second year students were calculated for both Phase 1 items and Phase 2 items in the four categories, and comparisons were made between the first year and second year students' performance.

Results: Content Relevance and Content Taught

Table 1 presents the number of items in the total test which were assigned to each category. The 15 Phase 1 reviewers considered 32 percent of the 988 items unrelated to the Phase 1 curriculum and 68 percent related to the content of at least one Phase 1 subject committee. Information necessary to answer 51 percent of the items was taught in the first year. In the judgments of the 22 Phase 2 reviewers, almost 15 percent of the items were not related to the Phase 2 curriculum, and 85 percent were relevant to the content of at least one Phase 2 subject committee. Sixty percent of the items could be answered based on instruction provided in the second year. When the reviews of the Phase 1 and Phase 2 faculty were combined, the results indicated that 2.7 percent of the items were not related to either Phase. While 12.2 percent were related to the content of at least one Phase 1 or Phase 2 subject committee, the information necessary to answer these items was not taught in the curriculum of the first two years. Eighty-five percent of the items were related to the content of at least one Phase 1 or Phase 2 subject committee, and the information necessary to answer these items was taught in one or more subject committees.

The percent of items in each of the seven subtests related and not related to the combined Phase 1 and Phase 2 curriculum was determined. These

Table 1

Classification of NBME Part 1 (June 1974) Items

Category	Phase 1	Phase 2	Phase 1 and Phase 2
No. of items not relevant	315 (31.9%)	146 (14.8%)	27 (2.7%)
No. of items relevant and taught	501 (50.7%)	590 (60.0%)	121 (12.2%)
No. of items relevant and not taught	118 (11.9%)	243 (25.0%)	840 (85.0%)
No. of items relevant and don't know	54 (5.5%)	9 (1.0%)	

data are summarized in Table 2. In this particular NBME examination, 98.6 percent of the physiology items were relevant to the content of the first two year curriculum and had teaching emphasis. Approximately 90 percent of the anatomy, biochemistry and pathology items were related to and taught in the first or second year. Only 74 percent of the pharmacology items and 62 percent of the behavioral sciences items were content-related and had information taught in the Phase 1 and Phase 2 curricula.

Phase 1 related and taught items ranged from 1 percent for behavioral sciences to 82 percent for microbiology. Information related to approximately 75 percent of biochemistry and physiology items, and approximately 33 percent of pathology and pharmacology items was taught. More items were related to the content of the Phase 2 subject committees and were emphasized in the teaching. The greatest representation was in physiology, followed by pathology and anatomy. The least was in microbiology.

The faculty reviewers from Phase 2 were asked to list topics or areas taught in their particular subject committees which had not been covered in the NBME examination. Among the identified topics were: head and neck anatomy and neuroanatomy, child development and adult psychopathology, valvular disorders, esophageal and intestinal motility and associated pathophysiology, and mechanisms underlying development of acidosis in renal disease. The reviewers also designated those items which were ambiguous, trivial, or poor quality. Many of the items considered to be "poor" questions by the CWRU faculty a priori were included in the 41 items deleted by the National Board on the basis of performance of the national group.

Results: Student Performance

Mean scores were calculated for first year student and second year student performance in the following categories: Phase 1-relevant and taught items, Phase 1-relevant and not taught items, Phase 1-not relevant items, Phase 2-relevant and taught items, Phase 2-relevant and not taught items,

Table 2

Percent of Content-Relevant and Taught Items

Subtest	Phase 1	Phase 2	Phase 1 and Phase 2
Anatomy	46.2	77.6	90.9
Behavioral Sciences	0.7	61.5	61.5
Biochemistry	77.1	44.4	90.3
Microbiology	82.4	17.6	86.8
Pathology	37.7	79.5	91.1
Pharmacology	33.6	53.6	74.3
Physiology	75.7	81.3	98.6

and Phase 2-not relevant items. A t-test for independent samples was used to make comparisons between differences in mean scores of the Phase 1 and Phase 2 students in each classification.

The results of these analyses are summarized in Table 3. Second year students achieved statistically significant higher scores than did first year students in three categories: 1) items relevant to the content of the second year with teaching emphasis in the second year subject committees, 2) items related to the first year curriculum, but not taught in the first year; and 3) items not relevant to the first year curriculum. The higher performance by the second year students in the second category could be explained by the fact that items related to Phase 1 but not having teaching emphasis in the first year may have had curricular emphasis in the second year. In the third category, many of the items not related to Phase 1 could have been related to the Phase 2 content.

Independent sample t-test comparisons were made between the performance on content-related items which were taught and content-related items which were not taught. Both first and second year students obtained statistically significant higher scores on items whose content was related to the Phase 1 curriculum and taught than on items whose content was related to the Phase 1 curriculum but not taught. Second year students achieved statistically significant higher scores on Phase 2 related and taught items than on Phase 2 related items whose content was not taught. There was no difference in the mean scores of first year students on items related to Phase 2, whether with or without teaching emphasis. Tables 4 and 5 present these findings.

Discussion

The information generated by the faculty review of the NBME Part 1 examination revealed that much of what was asked was not taught in the second year CWRU curriculum. Only 60 percent of the questions could be answered by information provided in the Phase 2 subject committees. There were

Table 3

Performance of Second Year Students Compared to Performance of First Year Students - Total Test

Category	No. of Items	t	p
Phase 1-relevant and taught items	501	-0.87	N.S.
Phase 1-relevant and not taught items	118	2.53	$<.01$
Phase 1-not relevant items	315	5.81	$<.001$
Phase 2-relevant and taught items	590	5.81	$<.001$
Phase 2-relevant and not taught items	243	-0.43	N.S.
Phase 2-not relevant items	146	-0.64	N.S.

Table 4

Performance on Phase I Relevant Items and Taught Compared to Phase I Relevant Items and Not Taught

Group	t	p
First Year Students	7.47	<.001
Second Year Students	4.58	<.001

Table 5

Performance on Phase 2 Relevant Items and Taught Compared to Phase 2 Relevant Items and Not Taught

Group	t	p
First Year Students	-1.92	N.S.
Second Year Students	3.20	$<.01$

significant areas which were taught in the second year, but were not tested in this examination. Yet the Part I examination was being used as the second year comprehensive. This disparity between the content of the National Board examination and the CWRU curriculum influenced many students to spend a great deal of time preparing for the examination and were diverted from participating in the curriculum during the last two or three months of the second year.

A considerable number of first year students was able to pass the Part I examination at the end of Phase 1. The faculty review indicated that 50 percent of the questions could be answered on the basis of the first year course material. Students passing the National Board at the end of the first year were also passing the second year comprehensive before the second year began!

In terms of performance on the National Board examination, second year students scored higher than first year students on items whose content was related to and taught in Phase 2 subject committees; on items related to Phase 1, but not taught; and on Phase 1-non-related items. Both first and second year students achieved higher scores on items whose content was related to and taught in their respective subject committees than on items which were content related, but not taught. Teaching made a difference!

Faculty Decision

The data from this study were submitted to the Subcommittee on Intellectual Environment and Evaluation. The Subcommittee's charge was to review the current methods of evaluating student performance, to assess their influence on the intellectual climate of the school, and to recommend changes in policy which would improve the overall evaluation process and the intellectual climate. The results of this study were included in the Subcommittee's presentation concerning the National Board Part I at a faculty-student colloquy held in June 1975. The discussion and feedback generated from

this meeting resulted in two recommendations by the Subcommittee:

1. That the faculty no longer require CWRU medical students to take the NBME Part I examination.

2. That a required Phase 2 comprehensive examination created by the faculty be administered at the completion of Phase 2.

These recommendations were approved by the Committee on Medical Education and were subsequently presented to the General Faculty. After extensive discussions at two meetings in October 1975, the General Faculty voted to accept the recommendations. Starting with the class of 1979, CWRU second year students will take an internally developed examination at the end of Phase 2, and the NBME Part I examination will not be required.

Conclusion

The review of the NBME Part I by the CWRU faculty had an impact in decision-making and determination of policy. Although the National Board examinations had been required for more than two decades, there had not been a systematized review of these examinations in relation to the CWRU curriculum. As a consequence of this study, the faculty recognized that the NBME Part I examination was appropriate for licensure, but not appropriate for internal student evaluation. The faculty decision emphasized that internal evaluation of CWRU students should be the responsibility of the school's faculty and not left to an outside agency.

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